EXP (1): Specimen preparation for metallographic study microstruct

تشيئة تحضير

Sectioning → Mounting → Grinding → Polishing → Cleaning & drying → Etching

under running water.

water & ethanol (boiling temp. 70°C).

Grit no = # of sharp particles per square inch (unit Area).

320, 400, 600, 1200

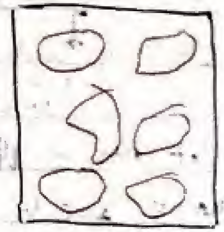
320: Rough surface (starting).
Larger → smoother surface (Ending)

1) Sectioning: cutting into specified Dimensions section

Sand paper: ~~ورق الصنفرة~~ : ورق الزجاج

2) Grinding: under running water to prevent over heating

Grain Boundary: The Area between different orientations of Atom is called g. boundary.



Poor microstructure: – ① Poor performance
② Reduced life span

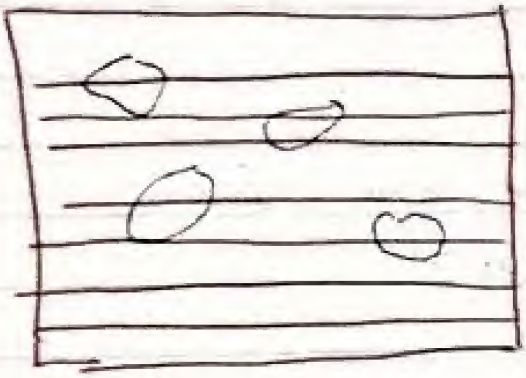
Partn air flight 394, 1989
– unaproved Air craft part
– counterfit not Authentic

③ Etching: – To make grain boundaries more visible (Dull).

Exp (2): Microstructure Examination

1- Study the micro.
2- Calculate grain size
3- calculate carbon content

* Finding the Grain size → Intercept method



grain size = $\frac{\text{Line length} * \# \text{ of lines}}{\Sigma \# \text{ of grain} * \text{Total magnification}}$

= $\frac{14.8 \text{ cm} * 7}{\# \text{ of grains} * \text{total mag.}}$

objective lens = 100 X
eye lens = 10 X
computer screen = 3 X

total mag. 3000 X (3)

* Find ASTM grain size.

American society for Testing Materials

ISO. International Standard organization
BSI. British Standard Institution.

$$N = 2^{n-1}$$

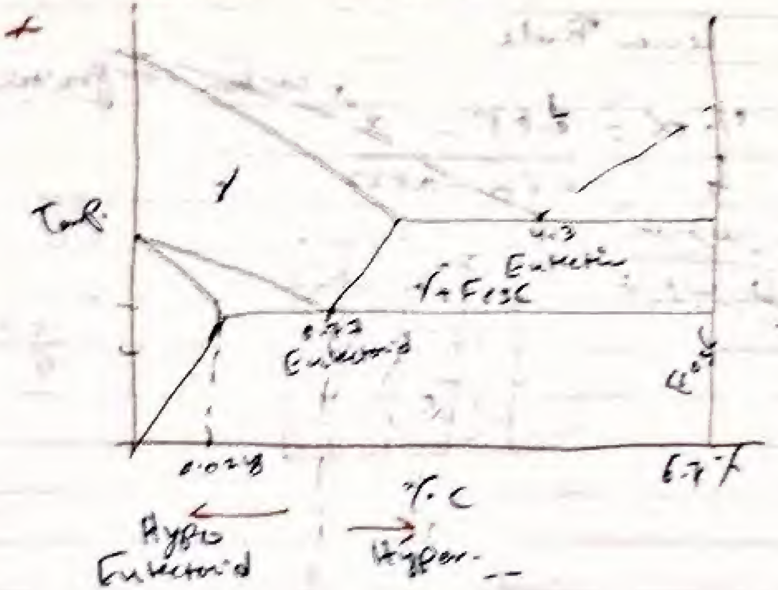
N: # of grain per square inch
n: ASTM grain size

at mag. > 100X

$$N\left(\frac{M}{100}\right)^2 = 2^{n-1}$$

M: total magnification. مقدار تكبير

+ Carbon content.



α: Ferrite 0.022% , Ductile, magnetic
γ: Austenite 2.14% Ductile, non ~
Cementite 6.7% carbon hard & Brittle.

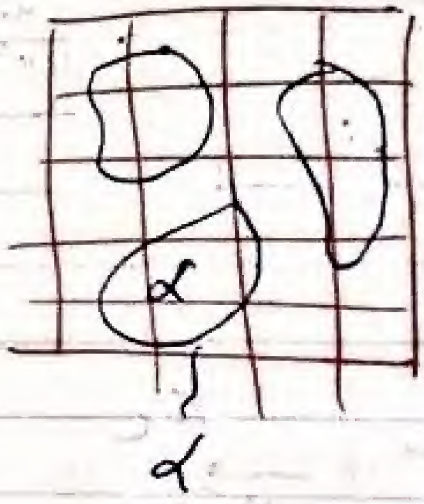
density Austenite > ferrite.

Lever Rule.

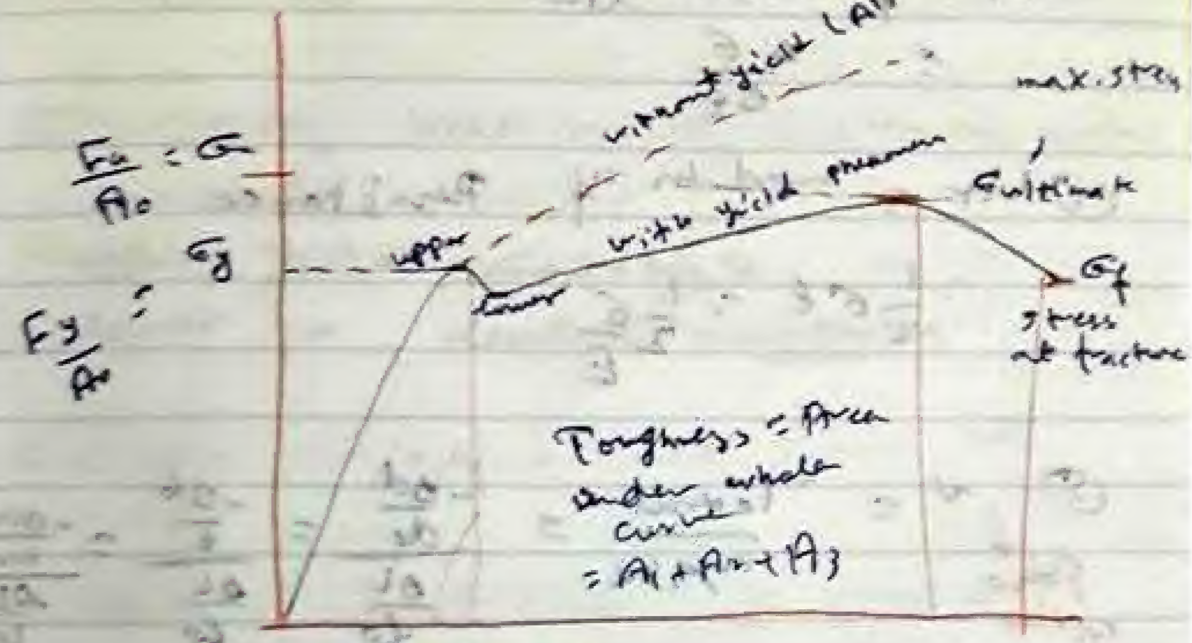
$$\%\alpha = \frac{6.67 - x}{6.67 - 0.022} \quad x = \text{carbon compos}$$

f_α

$\alpha = \dfrac{\text{عدد مربعات } \alpha}{\text{عدد المربعات الكلية}}$



Exp 4: Tensile test



$\varepsilon = \frac{\Delta l}{l}$ strain

$E = \frac{\sigma}{\varepsilon}$

- Percent reduction of Area

$$= \frac{A_0 - A_f}{A_0} \times 100\%$$

Percent of Elongation

$$\%\,el = \frac{l_f - l_0}{l_0} \times 100\%$$

(7)

(3) E = Youngs modulus of Elasticity

slope of elastic line

$= \frac{\Delta \sigma}{\Delta \epsilon}$

(4) U_r = modulus of Resistance

$= \frac{1}{2} \sigma \epsilon = \frac{1}{2} \frac{\sigma^2}{E}$

(5) $\nu = -\frac{\text{lateral}}{\text{axial}} = \frac{-\frac{\Delta d}{d_0}}{\frac{\Delta L}{L_0}} = \frac{-\frac{\Delta t}{t}}{\frac{\Delta L}{L_0}} = \frac{-\frac{\Delta w}{w}}{\frac{\Delta L}{L}}$

Poisson ratio always less than 1

Brittle ~~Ductile~~: ~~when~~ ~~then~~ when material is subjected to load it will fail with small deformation

ϵ less than 5%.

Ductile: The ability of material to deform without fracture deformation is bigger.

(8)

* The lesser E, to ductile is not the bigger E the stiffer is material

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To study behavior of material under uniaxial stress;

upper yield: ~~load~~ initiate

lower " load to maintaine

Husam Sulima

Exp 4 Tensile Test

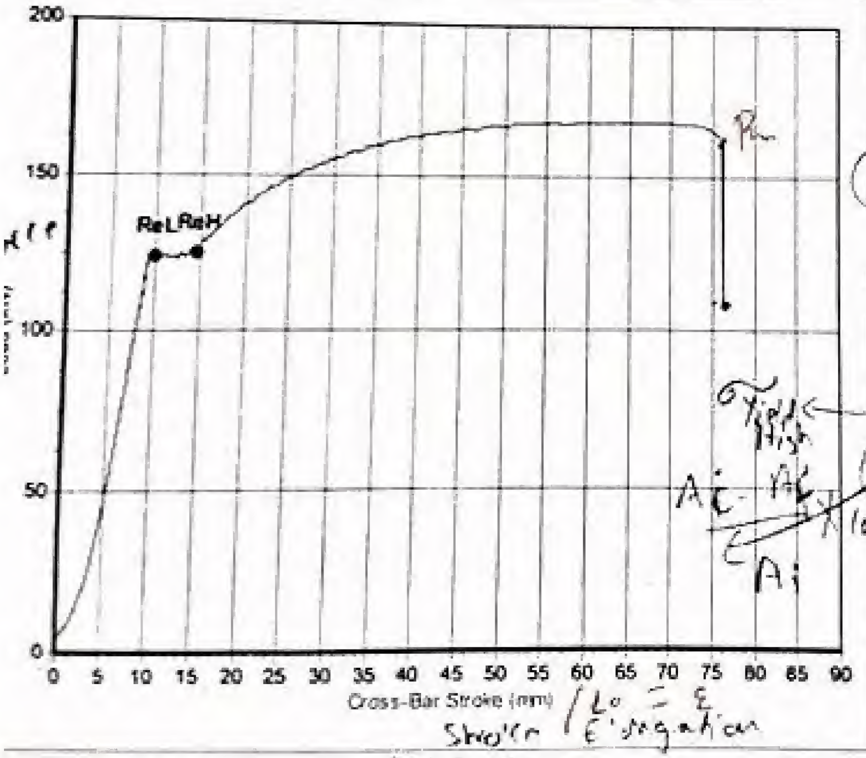
Yield

TENSILE TEST
STANDARD EN 10002/1

Certificate N° 83 of

Lot	Acez		Specimen	1/16	of
	02/03/2016				
Material	St.				
Tooled specimen			Ambient temperature		
Proportional specimen			Drawing position		
			Drawing direction		
Specimen	Round				
Diameter	18.10	mm	Speed 1	9.00	N/mm²/s
			Speed 2	6.00	mm/min
			Lo / Li = 18 cm	180.00	mm
			Le	.00	mm
Preloading time	.00	sec	Lc	262.00	mm
S = Ao	257.304	mm²	Lu final	220.00	mm

Elongation 220 − 180 = 40 mm



Stroke / Lo = ε Elongation

Tests results

fracture stress

Rm		653.846	N/mm²
A		22.222	%
Fm	Force	168.237	kN
FeL	Force at low yield	123.706	kN
ReL		480.777	N/mm²
FeH	Force at high	124.805	kN
ReH		485.047	N/mm²
Z		40.173	%

Yield High

$\frac{Ai - Af}{Ai} \times 100$

N/mm² = stress

Operator

Manager

Yield strength